Report to the Energy Efficiency Utility

Contract Administrator

Verification of

Efficiency Vermont Year 2005

Savings and Total Resource Benefit (TRB) Claim

Department of Public Service

June 7, 2006

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I. Introduction

On March 1, 2006, Efficiency Vermont ("EVT") submitted its "Year 2005 Preliminary Annual Report and Annual Energy Savings Claim" for calendar year 2005 activities operating as the statewide energy efficiency utility ("EEU"). As provided for in the contract between Efficiency Vermont and the Vermont Public Service Board ("PSB"), the Department undertook a review of EVT's 2005 activities, verifying the MWh savings and Total Resource Benefit ("TRB") amounts claimed by EVT. This report made to Michael Wickenden, Contract Administrator for the PSB, summarizes the results of that review.

The DPS provided preliminary findings to EVT and the Contract Administrator on May 19, 2006. On May 26, 2006, Efficiency Vermont provided a response to the DPS preliminary findings on items where the DPS recommended an adjustment to the 2005 savings claim. Agreement on savings adjustments was reached for all of the items identified in the DPS preliminary findings.

EVT has indicated it accepts all of the adjustments to the 2005 claimed savings recommended by the Department in this report. In some cases, EVT does not completely agree with the Department's rationale or methodology for the adjustment, and requests that the measure characterizations for 2006 be discussed more thoroughly through the ongoing DPS-EVT TAG process. These requests are noted under the specific measures.

Since the parties are in agreement on the magnitude of the 2005 adjustment, the issues and resolutions are briefly described. More discussion is provided for the current and ongoing issues described in Section III. For more detail about the adjustments, please refer to the Department's May 19, 2006 preliminary findings and EVT's May 26, 2006 response.

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The Department appreciates the significant progress EVT continues to make in promoting energy efficiency among Vermont's citizens and businesses. EVT provides a valuable resource for Vermont, both in terms of supporting the Vermont economy by expanding the infrastructure to deliver energy efficiency services and providing the groundwork for moving our state toward greater energy independence.

The results of the Department's verification process suggest that the EVT's preliminary 2005 savings are overstated by about 10.0% or 5,176 annualized MWh, indicating there is room for improvement in the methods used to calculate savings.[1] These adjustments are entirely associated with the business sector, and account for about 17% of the total claimed savings for the business sector. However, this result should not in any way detract from EVT's successes in encouraging Vermonters to save energy and in

[1] The results of the DPS review are quantified as reductions to annualized kWh or MWh gross savings at the customer meter. The EVT contract savings goals are expressed in MWh savings at generation, net free ridership and spillover effects. For this reason, these amounts are approximate and will be finalized by EVT when the changes are entered into the tracking system.

building the foundation for future efficiency efforts. EVT has surpassed its savings-related performance goals by a substantial margin, and the adjustments recommended in this document will not affect that achievement.

Similar to the process undertaken for the 2004 verification, the Department is basing its recommendations on the review of a stratified, random sample of C&I projects. This process was designed to ensure that the sample was weighted toward the larger projects that embody greater variability and more complex methods for calculating savings. Since the projects under review are reasonably representative of EVT's 2005 activity, the DPS is proposing a proportional adjustment to the C&I savings. This sampling and adjustment method should reflect what would otherwise result from a comprehensive savings review of all C&I projects, if resources and time permitted that approach.

Since many of the residential initiatives are primarily prescriptive in nature, the Department's review of this sector consisted largely of verifying that the agreed-upon savings as compiled in EVT's Technical Reference Manual (TRM) were correctly applied. This validation process could be easily conducted for the entire data set, obviating the need for random sampling. The remaining initiatives are relatively small in magnitude and the Department primarily reviewed the larger projects with higher savings. A couple of small anomalies were found in the residential sector that will have little impact on the claimed energy savings. A more substantial error regarding the demand savings for the Efficient Products program will need to be corrected.

The C&I adjustments relate to individual projects and also to methods and tools applying to whole categories of projects. Most of adjustment (4,368 MWh or about 84%) is associated with the C&I projects having the highest savings. This result seems to stem from two separate effects:

1) the larger, more complex projects require greater expertise and judgment in assessing the opportunities and estimating savings, and consequently have a higher potential for error, and
2) in some cases the savings were overstated to such a degree that a simpler project is elevated to be grouped with larger projects and subjected to a more rigorous review than would otherwise be the case.

The remaining 16% of the adjustment (808 MWh) stems from smaller C&I projects in which the errors found in the random sample are applied to the savings for the specified group as a whole.

The random sample consisted of 99 C&I projects covering the range of EVT initiatives in this sector. The Department is recommending adjustments based on 39 of these projects. The remaining 60 projects fall into two categories: 1) either no problems were identified or 2) the problems were such that the Department concluded they could be addressed on a prospective basis. The sampling and adjustment process is described in more detail under "Sampling Methodology."

Two adjustments to C&I measures were identified outside of this sampling process. The first one is related to the overstatement of water savings. Three projects outside of the random sample were found to have excessive and incorrect water savings. This issue would not be likely to surface through the random selection process since the sampling is conducted on the basis of energy savings. The Department recommends that the water savings and associated TRB be adjusted for these three projects. The other issue is associated with C&I prescriptive measures. There are errors in the data table used to

calculate the savings for these measures. These errors do not affect the gross energy savings, but are likely to have a small but noticeable impact on net savings, demand savings and the TRB. The Department and EVT have agreed that EVT will correct both the water projects and the prescriptive savings before implementing the adjustments identified through the random sampling process.

Table 1: Summary of Adjusted Projects

	Total # of Projects	# of Projects in Sample	# of Projects Adjusted
BNC	124	24	18
BEF Custom	353	57	15
BEF Prescriptive	329	18	6
Totals	806	99	39

The adjustments to annualized savings for all sectors are summarized in Table 2. The categories with titles such as "BEF – Top 9" reflect a census of the largest projects in the market sector, and all adjustments relate only to projects that were reviewed. In the other C&I categories, the percent reduction found among the random-selected projects was applied to all of the projects within the size category, as shown below. The relative precision for the randomly-selected custom Business Existing Facility (BEF), prescriptive BEF and Business New Construction (BNC) projects is 2.5%, 0.7% and 5.9% at the 90% confidence level, respectively.

Table 2: Summary of Adjustments

	# of Projects	Total Savings (MWh/year, Gross at Customer Meter)	Realization Rate	Adjust-ment (MWh/ year)	% Reduction
BEF - Top 7	9	7,326	50.6%	3,619	49.4%
BEF	344	12,854	95.0%	646	5.0%
BNC - Top 12	12	3,097	86.7%	411	13.3%
BNC	112	4,140	98.0%	84	2.0%
PRES - Top 6	6	765	55.7%	339	44.3%
PRES	323	1,767	95.6%	78	4.4%
Residential		21,720	100.0%	0	0.0%
Totals		51,669	90.0%	5,176	10.0%

The remainder of this report is divided into three sections. Section II details the project and measure-level issues that provide the basis for the adjustments shown in Table 2 above. Section III discusses specific issues with program year 2005 (PY05) projects and

other concerns to be addressed on a prospective basis. The final section describes the sampling methodology in more detail.

II. Project- and Measure-Level Adjustments

A. Business Existing Facilities: Custom

This section is divided into two parts. The first section includes all of the adjustments for projects with measures related to snowmaking and other measures installed at the ski resorts, with the project listed in alphabetical order. The second section explains the adjustments for the remaining BEF custom projects.

1. Ski Area Projects

EVT's 2005 claimed savings include a significant amount of savings derived from measures that address the energy used for snowmaking and other end uses at various ski areas. Seven of the nine largest projects for 2005 involved snowmaking and there were also snowmaking projects in strata 2 and 3 of the BEF custom sample. Through the review process, the Department has identified numerous issues with the characterization of these measures as well as the calculation of savings. Adjustments for the projects result in both increases and decreases to EVT's savings. They address pumping, efficient snow guns, water cooling and other measures.

The Department's issues are outlined more fully in following sections. EVT noted that a number of the Department's recommended adjustments have to do with the allocation between diesel and electric generators. EVT further remarked that many ski areas adjust the allocation between the fuel sources depending on the relative costs of the fuels, and requests that this issue be further discussed in the TAG process.

a. Jay Peak – Snowmaking 2004 and 2005 (Snow Guns)

Strata 3 & 4
Project ID: J00000206861 and J00000223060

In these two projects, performance data for a warm temperature range was applied to all of the projected snow making for snow guns that were being rebuilt. Snow gun performance improves at lower temperatures, so this resulted in an overstatement of savings. Correcting for the wider range of likely temperatures results in lower savings.

The savings for this project should be reduced by 52,287 kWh for the 2005 project, and 177,340 kWh for the 2004 project.

b. Jay Peak - Snowmaking 2004 (Air Compressor and Motor Controls)

Stratum 4
Project ID: J00000206861
MAS90 ID: 6013-3697

1) Compressed air, compressor

The measure life for rebuilding a compressor was beyond the time frame in which the work could be considered discretionary. Recognizing that EVT's involvement prompted the customer to action, the energy savings should be allowed but the measure life should be shortened to one year. The Department requests that EVT make the appropriate adjustments to the lifetime energy savings and TRB.

2) Custom motor control

This measure updated the drive and control system on Jay Peak's tram. The tram was previously operated by a motor-generator (MG) set and the ski area was having difficulty finding replacement parts. The management was in fear of the tram's imminent failure. This measure installed new controls and a new variable frequency drive to replace the MG set. The base case was described as a controls-only upgrade with the MG set remaining in place.

The difficulty of finding replacement parts and the fear of mechanical failure indicate this measure was required in order to continue safe and reliable operation. Accordingly, the measure life should be shortened to one year to reflect the imminent nature of the replacement.

The Department recommends that EVT make the appropriate adjustments to the lifetime energy savings and TRB. EVT requests that the issues associated with the measure life for the compressor rebuild and the custom motor control be further addressed in the TAG process.

c. Killington Mountain - LP3 and Ranger heads

Stratum 4
Project ID: J00000218898

Unsupported assumptions used in the calculation of snow gun savings result in extremely high savings for some snow gun measures. As more research needs to be done in this area, an adjustment to the baseline is the most equitable solution for this project.

The savings should be reduced by 128,881 kWh per year and the MMBtu from diesel savings by 2,463.4.

d. Magic Mountain - HKD

Stratum 2
Project ID: J00000224110

Magic Mountain currently has only diesel compressors, but savings were allocated equally to diesel and electric based on an assumption that Magic Mountain will continue to expand their snow making operation to the point where an electric compressor will be needed. However, savings for a second project at Magic Mountain are based on the assumption that new fan guns will *avoid* the purchase of electric compressors, including both electric savings and an offset to the costs reflecting the avoided purchase of an electric compressor.

The other issue with this project is lack of documentation of the make and model of the guns being replaced and the high energy use of the guns that were assumed for the baseline.

The DPS recommends that electric savings be decreased by 79,965 annual kWh as Magic Mountain has no electric compressors. Diesel savings should be increased by 251.8 MMBtu, which was calculated by assuming that diesel accounts for all of the project savings and then scaling these savings to a more conservative baseline.

e. Magic Mountain Ski Resort – Fan Guns

Stratum 3
MAS90 ID: 6013-5431

This project is an expansion of existing snow making, both from the project description and the designated market track. The choice is between purchasing a new standard efficiency gun or a high efficiency one. As such, an appropriate baseline is the median efficiency of the guns available on the market. EVT selected a baseline gun that is even less efficient than the standard list of options and was not supported by documentation in the file.

In addition, EVT's file does not clearly document whether the two diesel compressors are operating at capacity and whether Magic Mountain has the water resources to justify an expansion of their snowmaking capacity. This information is critical for supporting EVT's claim that Magic Mountain would have needed to add electric compressors to handle the new load.

The DPS recommends that the gun with the median efficiency should be selected for the baseline, resulting in a reduction of 72,018 kWh/yr. In the future, the Department requests that EVT provide better documentation showing the need for the new equipment when incorporating the costs and benefits of avoiding a major capital investment into the analysis.

d. Mount Snow - LP3 Guns

Stratum 4
Project ID: J00000214410

Unsupported assumptions used in the calculation of snow gun savings result in extremely high savings for some snow gun measures. Correcting the baseline unit and reducing the savings for the HKD Millennium Ranger to account for high baseline operation hours of use bring the savings more in the range of other efficient snow guns.

The Department recommends an annual kWh reduction of 653,380 and an MMBtu reduction of 4,640.7.

e. Stowe Mountain Resort - Snowmaking 2004

2. Stratum 4

Project ID: J00000204315
MAS90: 6013-3577

1) Snowmaking Water Precooling

This measure involves the installation of one 15 hp "bubbler" to aerate a 16 acre, 111 million gallon water reservoir. The purpose of the aerator is to cool the pond water to increase snowmaking efficiency. The average depth of the pond is about 20 feet.

The analysis provided to support this project included erroneous and unsupported assumptions. It was not possible to ascertain whether any savings could reasonably be expected from the project. Although there may be some merit to the technology, EVT has not provided sufficient documentation to support them.

The savings for this project should be disallowed, resulting in a reduction of 397,721 annual kWh and 6,612 MMBtu. EVT accepts the Department's recommendations in this case, and requests that the methodology be further explored in the TAG process since this technology may be useful in other applications.

2) Variable Frequency Drive

This project required a detailed calculation using pump specific curves, historical flow data and actual suction and discharge pressures. EVT's analysis was based on data from similar projects, which does not provide the degree of accuracy needed for a project of this magnitude. The DPS constructed a new analysis of savings based on the historical flow data, the pump curve, the suction and discharge pressures given in the file and conversation with the project manager.

As a result of this analysis, the DPS recommends an increase of 197,972 annual kWh.

3) Snowmaking Guns

This is an equipment replacement project. EVT used the Killington K3000 as the baseline snow gun, which is no longer produced in quantity. For an equipment replacement project, the baseline should reflect a likely market choice. The DPS recalculated the savings based on the performance of the median, standard snow gun. This analysis indicates that EVT may claim 128,630 kWh per year for these measures.

The savings for these measures should be reduced by 96,677 kWh, accompanied by a corresponding decrease of 1,090.8 MMBtu.

f. Stowe Mountain Resort - Snowmaking 2005

Stratum 4
Project ID: J00000213921
MAS90: 6013- 4538

1) Variable frequency drive, Snowmaking

This project included a measure for installing a variable frequency drive (VFD) on one of four 400 hp pumps that provides water for snowmaking on the newly expanded Spruce Peak. Flow data for the entire mountain was used to model the savings for this measure. However, the subject pump does not serve the entire mountain, but only the newly expanded Spruce Peak area. To estimate the water usage for Spruce Peak, we relied on the Environmental Board's decision, stating that the Spruce Peak expansion increased the total snowmaking acreage from 227 acres to 382 acres, an increase of 155 acres or 56%.

The adjustment for this measure amounts to a decrease of 32,299 annual kWh or 56% of the savings.

2) Snowmaking Process Controls

Controls and automatic valves were installed to allow snowmaking operations to be optimized based on real-time weather data. The control system monitors the data from weather stations on the mountain and adjusts the water and air flow to make the most snow with the least amount of water. The savings are calculated in two parts: (1) increased efficiency during snowmaking, and (2) reduced start-up time. While savings associated with the first part of the analysis (increased efficiency during snowmaking) are reasonable, the start-up savings are overstated.

The DPS recommends the savings associated with start-up be reduced by 115,222 annual kWh.

3) Snowmaking Guns

Unsupported assumptions used in the calculation of snow gun savings result in extremely high savings for this snow gun measure. The baseline unit was changed to one that has characteristics more compatible with the proposed usage parameters. The DPS

also changed the assumed operating parameters for the baseline to more accurately reflect actual performance.

The savings for this measure should be reduced by 264,077 gross, annualized kWh and 746.0 MMBtu.

g. Sugarbush – Tower Guns

Stratum 4
Projectid: J00000220193

All of the information required to calculate the savings from this project is provided in an e-mail from Sugarbush describing the project and its goals. EVT's use of other assumptions is not supported.

The DPS recommends that the electric savings should be removed and the diesel savings reduced to the level projected by Sugarbush. This results in an annual kWh reduction of 1,691,950 and an MMBtu reduction of 784.8.

2. Other Project-Specific Adjustments

a. Bernstein Display

Stratum 4
Projectid: J00000213874

This project involved the renovation of an existing manufacturing facility. Bernstein Display makes mannequins, which involves baking the raw material in molds. The measure is fuel switching, i.e., installing propane ovens rather than electric ones such as those used in Bernstein's Long Island facility. Two propane ovens were installed. This project required an Act 250 change of use.

EVT's methodology for calculating the heat loss from the ovens is simplified and a number of the assumptions are questionable, including the lower levels of insulation in the baseline oven. The estimated savings are higher than supported by the metered point estimate of KW use and the analysis conducted by the Department, which is consistent with the point estimate.

The Department recommends that the savings for this project be reduced by 145,082 gross, annualized kWh.

b. Black River Produce

Stratum 3
MAS90 ID: 6013-3881

The project involved the conversion of a facility to a refrigerated warehouse. To obtain compressor savings, EVT performed a detailed calculation to estimate the usage of both the baseline and the more efficient compressors for each area of the warehouse. These calculations constitute the basis for the consumption of the baseline system. However, the

usage of the efficient equipment was then re-calculated with generic assumptions. EVT also reduced both the heat rate *and* the time needed for the defrost cycle, which is unrealistic.

The same methodology should be used for the baseline and the efficient equipment. The defrost calculation should be corrected. These two adjustments result in a reduction of 80,231 gross, annualized kWh/yr.

c. NSA Industries

Stratum 3
Project ID: J00000209107

An air compressor with a variable speed drive and several other compressed air system upgrades, such as no-loss drains and an increase in header pipe size, were installed at this metal fabricating company. EVT used a generic part load curve to calculate the usage of the baseline air compressor and an equipment-specific curve for the new compressor. Equipment-specific curves should be used for both the baseline and efficient equipment.

The Department recommends a reduction of 47,364 gross, annualized kWh to this project. EVT has requested that the issues associated with the generic and equipment-specific compressor curves be taken up in the TAG process.

d. Parker House Fuel Switch

Stratum 3
Projectid: J00000020401

This is a 46-unit, subsidized housing facility for senior citizens. The project is financed by HUD. This project includes switching the electric space heating to propane and installing replacement windows. EVT installed other measures during the pre-installation period that may have affected the load to some degree (lighting and efficient clothes washers).

The general method for calculating the fuel switching savings is fine, but there were a few anomalies relating to the estimating of the base load. Also, the analysis period used for the fuel switching analysis included the installation of other efficiency measures.

The fuel switching savings should be reduced from 227,284 gross, annualized kWh to 207,752, resulting a total decrease of 19,729 kWh and a corresponding decrease in projected fossil fuel use.

e. Putney Paper - Pulper Drives

Stratum 3
Project ID: J00000221738

This measure replaced a 300 hp motor on a pulper with a premium-efficiency motor. EVT estimated savings for this measure based on assumptions of 89% efficiency of the baseline motor, 95% efficiency of the proposed motor, and 100% load. The average motor loading of 100% is not supported. In addition to the pulper motor replacement, this project also included installation of a VFD. The VFD measure used an average 87.5% load.

Adjusting the motor loading from 100% to 87.5% results in a reduction of 12,757 annual kWh.

f. University Mall Lighting

Stratum 4
Projectid: J00000216058

This is a custom, market opportunity, lighting project. A total of 506 efficient fixtures were installed. Of these fixtures, 152 were CFL hardwired fixtures, installed in the entryway and halls. For the 131, 4-lamp fixtures, the baseline was assumed to be a 4-lamp incandescent fixture with 100 W bulbs. The other 2-lamp CFL fixtures are assumed to replace 2-lamp incandescent fixtures with 150 W bulbs.

Incandescent fixtures are not a reasonable baseline for mall entryways and halls, particularly considering the high maintenance required to replace the bulbs. A more realistic baseline fixture for the entranceway and common corridor lighting is quartz halogen.

The Department recommends that the savings for this measure be decreased by 113,917 gross, annualized kWh.

B. Business Existing Facilities: Prescriptive

1. Cross-Project Adjustment

a. CFL Screw-in Bulbs

Projects Affected:

Highridge Owners Association (Project ID: J00000223026, MAS90 ID: 6013-5373, Measure ID: M00000842333)
Holiday Inn - Rutland - Rx Lighting
Carriage House Furniture - RX Lighting

The TRM contains an error in the CFL screw-in measure for the Commercial Energy Opportunities initiative (Measure Number: I-C-8-d). The correct wattage reduction should be 48.7. Claimed savings, however, were calculated using 58 W.

This issue affects both energy and demand savings. The Department recommends that the savings for the Highridge Condos be reduced by 17,784 gross, annualized kWh, and the Carriage House project savings be reduced by 10,284 gross, annualized kWh. For

the Holiday Inn, the correction for this error is incorporated into the adjustment listed below.

2. Project-Specific Adjustments

a. Asten-Johnson – RX Lighting

Stratum 3
Projectid: J00000222301

This project is marked in the database as prescriptive, but it is actually a custom project. The custom calculations indicate that the savings for this project are approximately 91 gross MWh. The claimed savings are 273 gross MWh. EVT explained that the custom savings were inadvertently overwritten with the prescriptive savings. The Department supports savings of 123 gross MWh, to reflect the higher lumen output needed for this application.

The Department recommends that the savings by reduced by 150,864 annualized kWh.

b. Holiday Inn - Rutland - Rx Lighting

Stratum 3
Projectid: J00000222297

This project is prescriptive and involves the purchase of 1,000 CFL screw-in bulbs. The facility is 95,000 square feet. EVT reports that the bulbs were installed in the guest rooms. The default hours of use from the TRM were used to calculate savings, which is 2,697 hours per year or a little over 7 hours per day.

Given that these bulbs were installed in the guest rooms, the assumption of seven hours of use per day are likely to be overstated. In another project involving CFL bulb purchases by a hotel (Hampton Inn), EVT assumed 4 hours per day at 50% occupancy, i.e., two hours per day. Energy and demand savings were also overstated due to the TRM error regarding the change in wattage.

The Department recommends that the savings be reduced by 116,030 gross, annualized kWh.

c. Midas Automotive Services – S. Burlington - RX Lighting

Stratum 2
Projectid: J00000017179
MAS90 Project: 2592
MAS90 Job: 6013

The savings are based on 4,368 hours of use per year, equating to about 12 hours of use per day, every day of the year. However, reported hours of operation for this Midas location are 7:30 to 5:30 Monday through Friday, 8:00 to 4:00 on Saturdays, and closed on

Sundays. This works out to roughly 3,640 hours assuming one hour on each end for opening and closing and open all holidays. Thus, it appears that the hours of use are overstated for this project.

Correcting the hours of use results in a reduction of 3,592 annualized kWh.

d. Putney Paper – Motors 20

Stratum 2
Projectid: S00000212216

Ten motors were installed at this location. Savings were calculated in the spreadsheet-based, prescriptive motors tool. EVT explained that the Visual Basic code used to calculate the savings in the tool erroneously inflates the quantity of motors installed in some cases.

Correcting the quantity of motors installed results in a reduction of 7,314 annualized kWh.

C. Business New Construction

1. Cross-Project Adjustment

a. Multifamily "Comprehensive Track" Lighting

Projects in BNC Stratum 1: Cabot Commons (J00000017096, 6019-1025), Butterfield Townhouses (J00000221113, 6018-5106)
Projects in BNC Stratum 2: Gardens Phase II (J00000024167, 6018-2115)
Projects in BNC Stratum 3: Eastwood Commons (J00000023674, 6019-1050), Vernon Hall II (J00000017036, 6018-2080), O'Dell Place - Building 5 City's Edge (J00000023679, 6018-2105)

EVT calculates the savings for the comprehensive track MFB lighting in the CAT tool using a look up table. The look up tables include the hours of use, original and new wattage and kWh savings by measure. EVT updated the hours of use for a number of the lighting measures, but did not make the corresponding change to the energy savings. Since the tool is set up to pick up the kWh savings directly from the look up table, the savings are incorrect for many of the lighting measures in the MFB comprehensive track. For most of the measures, this error results in an overstatement of savings.

The Department recommends that the lighting savings for six MFB projects in the sample need to be adjusted downward, as shown in the table below. Additional adjustments are made to some of these projects, as discussed in more detail in the following sections.

Table 3: MFB Comprehensive Track Lighting Adjustments

Project Title	KWh Reduction
Cabot Commons	2,126
Butterfield Townhouses	2,049
Gardens Phase II	4,304
Eastwood Commons	27,656
O'Dell Place - Building 5 City's Edge	13,246
Vernon Hall II	4,095

b. Multifamily Common Area Lighting

Stratum 3
Vernon Hall II (J00000017036, 6018-2080) and
O'Dell Place - Building 5 City's Edge (J00000023679, 6018-2105)

EVT uses incandescent fixtures as the baseline for most of the common area lighting in the MF buildings that is not installed through the comprehensive track discussed above. This issue is particularly problematic for the corridor lighting in O'Dell Place and the laundry fixtures in Vernon Hall. The incandescent baseline is no longer appropriate for this application. Incandescents have high maintenance costs in addition to excessive energy use. These considerations would tend to make them unattractive for high use locations. The TRM assumption is fluorescent lighting for the baseline in the comprehensive track for laundry and common areas. The TRM baseline is consistent with the results from recent audit conducted by GDS Associates for subsidized housing in Massachusetts and New Jersey.

The DPS recommends that the baseline be adjusted to be consistent with the TRM for corridor and laundry/common area lighting. This modification results in a reduction of 8,129 gross, annualized kWh for Vernon Hall and 30,275 kWh for O'Dell Place.

c. Lighting Occupancy Sensors in Schools

Projects: Bradford Elementary School (Stratum 2) and
CVU – Expansion (Stratum 3)
Project ID's: J00000007404 and J00000020503

EVT used the default assumption, found in the TRM, of 30% reduction in lighting use due to the installation of occupancy sensors in these two schools. These are custom projects, and information from other sources suggest that 20% is a more accurate reflection of the potential savings for occupancy sensors in schools.

Assuming 20% savings reduces annual energy savings by 5,658 for the Bradford Elementary School and 10,938 for the CVU Expansion project.

2. Project-Specific Adjustments

a. Clarion Hotel - New Addition

Stratum 3
Projectid: J00000016983
MAS90 Project: 6014-1627 (Act 250)

This custom project involved the construction of a new addition for the Clarion Hotel. EVT did not use the Act 250 baseline for the cooling measure in this project.

Adjusting the baseline to Act 250 standards for the package terminal heat pumps results in a reduction of 33,802 annualized kWh.

b. CVU – Expansion

Stratum 3
Projectid: J00000020503
MAS90 ID: 6014-1727 (Act 250)

This project consisted of the renovation of and addition to the Champlain Valley Union High School. One measure (labeled HA3) involved the installation of an air conditioning unit with an EER of 12.1. EVT did not use the Act 250 baseline for this measure.

Adjusting the baseline to the Act 250 Guidelines for this unit results in a reduction of 2,127 annualized kWh.

c. Dionne Grocery Store

Stratum 2
Projectid: J00000205905
MAS90 Project: 6014-3554 (Act 250)

This project relates to the construction of a grocery store. The project incorporated energy efficiency measures designed to improve the building's lighting, mechanical systems, and envelope. For the exterior lights, 70W pulse-start metal halide fixtures were chosen, and energy savings were calculated using 200W halogen fixtures as the baseline. In addition, sky lights and sun tubes were installed to help light up some display areas, and manual dimmer controls were installed to allow store employees to dim the display lights when there was ample daylight. Savings for the day lighting measure were calculated on an assumed value on how often display lighting could be manually dimmed.

A halogen fixture does not conform to the minimum requirements for an Act 250 project. The correct baseline is a standard metal halide fixture. The energy savings for manually controlled lights as a day lighting efficiency measure are not sufficiently reliable to be counted as claimed savings.

Adjusting the exterior lighting baseline to Act 250 standards and removing the manually controlled day lighting measure results in a reduction of 4,138 annualized kWh. EVT requests that the issues associated with claiming savings for manual dimming be further investigated in the TAG process.

d. Gardens Phase II

Stratum 2
Projectid: J00000024167

EVT erroneously entered a baseline wattage of 1.6 for efficient light fixtures and consequently claimed an increase in use of 2,775 kWh for this measure. The savings should have been calculated from the correct baseline of 60W.

The savings for this measure should be increased by 11,255 gross, annualized kWh.

e. Gregory Supply

Stratum 3
Projectid: J00000202124
MAS90 Project: 6014-3265 (Act 250)

This project involves the construction of a new Gregory Supply Store. Savings for two of the interior lighting efficiency measures were based on the installed lighting power density (LPD). The baseline values were incorrectly based on industrial workspace rather than retail warehouse.

For the exterior lights, 100W pulse-start metal halide fixtures were installed, and energy savings were calculated using 300W halogen fixtures as the baseline, which is not consistent with Act 250 requirements.

In addition, sky lights were added to provide day lighting, and manual controls were installed to allow store employees to turn off lights as needed when there is ample daylight. Savings for the day lighting measure were estimated by assuming the frequency and duration that the lights would be manually turned off. However, savings from day lighting combined with manual controls are likely to be highly unreliable.

The Department recommends a reduction of 161,595 gross, annualized kWh to this project. As mentioned above under the Dionne Grocery Store, EVT has requested that savings from manual dimming be referred to TAG.

f. Indoor Recreation of Orleans County - Community Center

Stratum 3
Projectid: J00000008521
MAS90 Project: 6014-1439 (Act 250)

This project included the installation of a 22-ton air cooled chiller with an EER of 10.16. The energy savings calculated for this chiller used an air cooled heat pump with an EER of 9.0 as the baseline, which is not consistent with the Act 250 requirements.

Adjusting the baseline to the Act 250 Guidelines for air-cooled chillers results in a reduction of 1,393 gross, annualized kWh.

g. Lancaster at O'Brien Farm

Projectid: J00000025385
MAS90: 6019-1054

EVT calculated the ventilation savings based on a baseline fan, identified as a Broan, with 80W, but this fan is not rated for continuous use. Given that this project requires continuous ventilation, the corresponding Broan fan draws 50W.

Basing the savings on a 50W baseline fan reduces savings by 36,791 gross, annualized kWh.

h. Landmark College - East Admin Building

Stratum 2
Projectid: J00000210600
MAS90 ID: 6014-3921

This is a custom project involving a renovation of the Landmark College East Administration Building. Custom Measure #2 involved the installation of energy recovery ventilator (ERV). The energy savings calculation spreadsheet for this measures accounted for the additional electric energy the fan used over a standard ventilation system and subtracted it out of the savings claims. This spreadsheet used 5,533 hours of fan run time to calculate the kWh that needed to be subtracted out. The hours of use should have been consistent with 6,570 run time hours assumed for the premium efficiency motor installed with the ERV supply fan.

Adjusting the ERV fan run time hours to 6,570 results in a reduction of 1,853 annualized kWh.

i. Mylan Technologies - Pump VFD

Stratum 3
Projectid: J00000217895
MAS90 ID: 6014-4841 (Act 250)

This is a custom project involving the installation of premium efficiency motors and VFDs on cooling and heating loop centrifugal pumps at Mylan Technologies. EVT calculated the savings using an exponent method given in the TRM. In the spreadsheet, they used an exponent of 2.5 to calculate the energy savings from the VFD. The correct exponent for this application is 2.2.

Adjusting the exponent to 2.2 for the calculation results in a reduction of 8,287 gross, annualized kWh.

j. Vermont Law School – Addition

Stratum 2
Projectid: J00000015706
MAS90 Project: 6014-1592 (Act 250)

The project involved a renovation and addition at the Vermont Law School. For the air conditioning efficiency measure, a 36 ton high efficiency air cooled chiller with an EER of 11.2 was installed. The energy savings calculated for this chiller used a baseline of 9.22 EER. For the exterior lights, 50W pulse-start metal halide fixtures were installed, and savings were calculated using 150W halogen fixtures as the baseline. These baselines are not consistent with the Act 250 requirements.

Adjusting the baseline to Act 250 standards for these two measures results in a reduction of 3,541 annualized kWh.

k. Vermont Mutual Insurance – Montpelier

Stratum 3
Projectid: J00000023542
MAS90 Project: 6014-1744

EVT calculated kWh savings for the recommended chiller using the temperature bin method. The balance point to start cooling savings was set at the 47º F temperature bin. The 47º F balance point for cooling savings is too low. In discussions with EVT, they agreed that cooling for the building would probably start at a temperature higher than 47º F. The savings were recalculated with a balance point of 57º F.

The Department recommends a reduction of 11,778 gross, annualized kWh.

l. VSB - Rutland Courthouse New Construction

Stratum 3
Projectid: J00000015708
MAS90 Project: 6014-1588 (Act 250)

This custom project involves the construction of a new Vermont State District and Family Courthouse in Rutland. All savings claims were estimated based on a non-Act 250 baseline. The Act 250 baselines should be applied to this building since all Vermont State buildings are required to use the Act 250 energy guidelines.

Adjusting the baseline to Act 250 standards results in a reduction of 60,045 annualized kWh.

m. Vernon Hall – II

Projectid: J00000017036
MAS90 ID: 6018-2080

EVT erroneously entered a new wattage of 34 for the bathroom vanity fixtures. The savings should have been calculated from the correct wattage of 59. In addition, EVT claimed average water savings of 17.28 ccf/year per unit for replacement toilets. The water savings are overstated due to an error in the assumed occupancy of this multifamily building.

The savings for the lighting measure should be decreased by 546 gross, annualized kWh. The water savings should be corrected to 8.51 ccf/year per unit, resulting in a total reduction 342 ccf for the 39 dwelling units.

D. Adjustments to Water Savings

1. Montpelier, City - Water Filtration Plant - Leak Correction

Projectid: J00000221605

EVT provided financial assistance to Vermont Rural Water Association to allow them to purchase advanced leak detection equipment. This new equipment was used to help locate a water leak in one of Montpelier's underground water pipes. The size of the leak was estimated at 130 gpm based on flow rate trends. Water savings were calculated assuming a 130 gpm flow rate and the electric savings were claimed based on the pumping the extra 130 gpm. EVT assumed a measure life of five years.

The Department's conversation with personnel at the water utility indicate that the water utility knew they had a leak, had narrowed down the general area of the leak and used the Vermont Rural Water Association's equipment to pin point the leak's location to minimize road excavation. Under these circumstances, the five-year measure life is not a reasonable assumption.

Both water and electric savings were claimed for this measure. Since the cost of the pumping is included in the water avoided costs, claiming savings for both is inappropriate. In addition, as this customer is a water utility not an end use water customer, the water avoided costs may not be appropriate for this situation. The Department requests that the assumptions for future water leaks and the cost of water for a water utility be referred to the TAG process.

The water savings should be based on a 90-day period, requiring a downward adjustment of 68,829 ccf. It may be easier for EVT to implement this change by reducing the annualized water savings to reflect the 90-day period and changing the measure life to one year.

2. Manchester, Town - Water Department - Leak Correction

Projectid: J00000224077
MAS90 Project: 6012-5538

This project is similar to the City of Montpelier water leak discussed above. The leak detection equipment was used to help locate a water leak in the Manchester Town Water Department's underground water pipes. The size of the leak was estimated at 15 gpm. The energy savings were based on the electric energy used for pumping to refill the water tower based on the 15 gpm leak. The measure life is assumed to be five years.

As explained above, claiming water savings in addition to electric pump savings is not appropriate for a water utility customer, and the Department recommends this issue be further discussed as part of the TAG process.

The Department recommends that the measure life be set to one year and requests EVT to recalculate the TRB associated with this project.

3. Foxbrook at Arbor Gardens

Project ID: J00000016263
MAS90 ID: 6019-4576
Measure ID: M00000817108

EVT made a data entry error and claimed 257 ccf/year per machine for installed Energy Star washers, rather than the 2.57 ccf/year calculated in their tool.

The water savings should be corrected, resulting in a total reduction from 4,626 ccf to 46.26 ccf for all 18 washing machines.

E. Residential Adjustments

1. Efficient Products Commercial CFL Bulbs

EVT's demand savings for the commercial CFL bulbs purchased in the Efficient Products initiative are not consistent with the TRM. The Department requests that EVT

correct the assumptions to be consistent with the TRM and recalculate the demand savings for the winter, summer and shoulder coincident peak periods.

III. Issues to be Addressed on a Prospective Basis

A. MFB Lighting

EVT is assuming that the baseline is incandescent for most high use locations, such as corridors and common areas. These assumptions are not consistent with the experience of the DPS's verification team and the Department recommends the baseline for these measures be reviewed.

B. CFL bulbs and Fixtures in the C&I Prescriptive Track

The TRM assumptions for CLF bulbs and fixtures for C&I prescriptive applications should be reviewed, particularly the hours of use and baseline assumptions. The current baseline for these products is incandescent, which is not likely to be appropriate for many commercial applications. For CFL screw-in bulbs, the default hours of use are the same as for fixtures, which seem likely to overstate savings.

C. Commercial CFL Bulbs in the Efficient Products Program

The Department is concerned regarding the high penetration of CFL bulbs purchased through the Efficient Products that are apparently intended for commercial applications. In 2004, commercial purchases accounted for 11% of the total products sold and contributed 37% to the gross lighting savings for the program. In 2005, these commercial sales account for 24% of the total CFL bulbs sold through the program and 53% of the total EP savings for this measure.

This question was raised in the 2004 verification and discussed by the parties in the TAG process, resulting in the addition of an in-service factor and a reduction in the waste heat assumptions. The Department continues to have many questions about the actual disposition and hours of use of these bulbs. The possibilities range from multifamily buildings to home offices to more established commercial establishments, and the standard commercial hours of operation may not be appropriate for many of the actual applications.

The Department requests a complete review of this component of the program, including the method used to identify commercial purchases and all of the assumptions associated with this measure.

D. Prescriptive v Custom Projects

EVT does not appear to have a consistent method of differentiating between large prescriptive projects and custom projects. For example, the Asten-Johson lighting project

was put in both categories, resulting in the overwriting of the custom savings with prescriptive savings and a fairly large overstatement of savings. The notes in the Asten-Johnson file suggest that it was categorized as custom because the facility is larger than 10,000 square feet. In contrast, the Holiday Inn and Peerless Clothing were treated as prescriptive although they are 95,000 and 25,000 square feet, respectively. Both of these projects should have been treated as custom.

This verification process illustrates how important it is to ensure that projects are put in the correct categories. Prescriptive assumptions are appropriate for smaller projects, and on average the savings are likely to be reasonably realistic. For large projects, however, one incorrect assumption can result in a substantial over- or under-statement of savings.

E. Snowmaking Tool

While recognizing that the snowmaking tool represents a significant effort on the part of EVT to quantify the savings derived from snow gun replacement and upgrades using a consistent methodology, the Department has some serious concerns with many of the internal assumptions in the tool as well as the manner that it is being used. The Department recognizes that estimating snowmaking savings is not a trivial exercise and unfortunately there was not sufficient time in the verification period to investigate all of the issues that arose. The Department's concerns relate to the methodology, the assumptions regarding the operating parameters, review of the projects within the context of the entire snowmaking activity at the ski resorts and the proper documentation of existing conditions. Please refer to Section II.A.1. for a more detailed description of the issues.

Considering the numerous issues that surfaced in the review and the magnitude of the savings claimed by EVT, the Department recommends that this issue be added to the TAG process for 2006.

F. Furnace Fans

The Department found that the furnace fan savings claimed for the Residential New Construction program were not consistent with the TRM. EVT claimed 535 kWh per year, as opposed to the 484 kWh in the TRM for homes with both heating and cooling. Since only seven installations were completed in 2005, the entire adjustment would come to 357 kWh. Consequently, the DPS is not suggesting that EVT make the correction for 2005, but requests that EVT correct it for 2006.

G. Act 250 Baselines

The Department identified numerous Act 250 projects in the verification process in which the Act 250 baseline was not used. In addition to the specific projects listed in this document, EVT also claimed savings for LED exit signs, although this measure is required in all Act 250 projects. The Department requests that EVT address this issue and improve its methods for ensuring that the correct baseline is consistently selected.

H. Residential Retrofit Savings

The methodology used to estimate savings in residential retrofit projects for lighting, refrigeration and domestic hot water conservation sometimes results in high savings per home in comparison to total household usage. An example of this was found in EVT's 2005 claimed savings. Sixteen homes show savings greater than 2,500 kWh for these base load measure or 1,000 kWh for lighting only. The average savings for these homes is 2,736 kWh, while their total annual use is only 3,668 kWh, suggesting these participants will now use approximately 900 kWh year as a result of installing these measures, i.e., they are expected to save about 75% of their total use. This seems unlikely. EVT should develop methods to ensure that the total savings per household does not exceed a reasonable proportion of the pre-installation use.

I. Tools and Systems

This verification process raises some significant concerns regarding the accuracy of the tools and systems developed by EVT for estimating savings. At least six of the adjustments listed in this document relate to flaws in standardized tools or assumptions, including the following:

- problems with methodology and assumptions in the snowmaking tool,
- errors in the calculation of the prescriptive motors savings,
- inadvertently overwriting custom savings with prescriptive savings for a custom project,
- incorrect savings values in the look up table for MFB lighting,
- demand savings that do not match the TRM for CFL screw-in bulbs for commercial purchases in the Efficient Products initiative, and
- inflated values of the energy and demand savings for CFL screw-in bulbs in C&I prescriptive projects due to incorrect values in the tool.

The Department is concerned about this apparent lack of attention to detail and development of sufficient quality assurance mechanisms to ensure that the tools are operating as expected and contain the correct inputs. Given the time and energy expended in establishing reasonable values for prescriptive savings, it is troubling that these agreements are not consistently and correctly applied.

J. Free Ridership for CFL Fixtures in the Commercial Sector

EVT currently applies a free rider rate of 11% for CFL fixtures installed in the Business Existing Facility sector. However, the Department questions whether this value is understating actual free ridership. For example, the project overview for the University Mall project specifically states that the participant had chosen the light fixtures prior to contacting EVT. This situation suggests that the University Mall is a free rider. After making the adjustment to the savings recommended in Section II.A.2.f, University Mall accounts for 58% of the savings for this measure and 32% of the total lighting savings for the custom track of the BEF, as shown in the table below. Given that this single project has

a huge impact on the total lighting savings for this track, the free rider rate for 2005 is likely to be higher than the current estimate. The Department requests that this issue be considered in the context of the 2006 TRM review process.

Table 4: University Mall Lighting Savings

BEF Custom Track (6013CUST)	Total kWh	University Mall	% University Mall	Free Rider Rate
Compact fluorescent interior fixtures	150,046	86,924	58%	11%
Total Lighting Savings	976,492	308,280	32%	11%

K. File documentation

Although there have been some improvements in the documentation of projects from the first verification, the Department continues to find insufficient information in many project file to verify savings. This is particularly true for larger more complex projects. It is also an issue within some of the analysis tools that EVT has developed. The addition of the project overviews is helpful, although the quality varies widely and they are completely missing for some projects. In order for savings to be verifiable a project should have readily available the following information:

1. Documentation of savings methodology & assumptions

The methodology and rationale used to derive the savings needs to be clearly defined. The source of any factors, assumptions, profiles, etc. should be documented. For example, EVT was unable to locate the source for pond water temperatures used in a project at Stowe and has provided only partial information on the sources used for snow gun performance.

2. Recommendations

EVT needs to have a record of recommendations made to the participant and the screening that demonstrated the measure is cost effective. This information should be included in every file. The Department was unable to find documentation of the screening for one of the pipeline measures installed at Killington, and this measure is apparently not cost-effective by a large margin. Although there is a note in the file that indicates the measure was recommended, there is no information in the file that demonstrates the measure was screened and initially found to be cost effective.

3. Bids

Copies of any and all bids for work on the project should be available. There should also be documentation of cost overruns. This type of documentation may have explained what happened with the Killington project referenced above.

4. Contract and Inspection Form

These items are generally in the file and in good order.

IV. Sampling Methodology

A stratified random sample was selected from EVT's 806 C&I projects. Sampling was conducted by project and the strata were defined according to the total annual energy savings for each project. This approach is assumed to provide sufficient precision for the other performance indicators (TRB, summer demand savings and lifetime kWh). The samples were selected independently for the Business New Construction (BNC) and Business Existing Facilities (BEF) initiatives, and for custom and prescriptive projects within the BEF. The specifics of the sampling strategy are listed below.

- The allocation of the sample to BNC, custom BEF and prescriptive BEF was initially determined approximately in accordance with the total annual energy savings associated with each initiative, and then adjusted to ensure an adequate sample within each category.
- The sample was checked to see if the lighting savings are roughly proportional to the initiatives as a whole and to ensure that it included most of the market tracks represented in the total population of C&I projects.
- A census of the largest projects in the custom BEF, prescriptive BEF and BNC initiatives were reviewed.
- For the most part, the cut offs for the strata and the sample sizes within each stratum were determined according to the methodology presented in the California Evaluation Framework.[2]

A few compromises were made in the sampling process for the BEF prescriptive track and the BNC. No modifications to the California Framework methodology were necessary for the BEF custom track. The adjustments to the other two tracks consisted of increasing sample sizes and modifying the cut offs to establish a top tier, as discussed below.

The sample size was increased for the BEF prescriptive track to improve precision. Basing the sample size on the proportion of annual kWh savings for the prescriptive projects would result in the review of less than eight projects, which would be insufficient

[2] TecMarket Works, et. al. The California Evaluation Framework. Project Number: K2033910. Prepared for the California Public Utilities Commission and the Project Advisory Group. June, 2004. Pages 327 to 339 and 361 to 384.

to estimate the realization rate within a reasonable degree of precision. In addition, the top tier of the prescriptive projects (the largest six projects) was established by inspection of the data. The California Framework method would have required additional strata to create a small group of the largest projects in the top stratum, and this added level of complexity did not seem to be warranted for the prescriptive track. All of projects in the top tier were be reviewed.

The highest stratum in the BNC program has 12 projects. While the sample size was set to six for the BNC, all 12 projects in the top stratum were reviewed to ensure sufficient oversight of the larger projects.

Table 5: Summary of Projects

	Total # of Projects	Total MWh Savings	% of Savings	# of Projects in Sample
BNC	124	7,237	24%	24
BEF Custom	353	20,180	67%	57
BEF Prescriptive	329	2,532	8%	18
Totals	806	29,949		99

The first sample selected did not adequately represent the variety of end uses for the both the BEF custom and prescriptive tracks. For this reasons, sampling of projects was conducted a second time and this second round produced a more evenly distributed sample.

The distribution of sampled projects in terms of the size of the projects is presented below in Table 6. This analysis shows that projects vary in size from 60 to 1,691,950 annualized kWh. The strata reflect a reasonable grouping of projects by size and is fairly representative in terms of lighting and air conditioning savings. There is more variability for motors and refrigeration measures.

Table 6: Distribution of Sample by Project Size

	Stratum	# of Projects	Min (kWh Savings)	Max (kWh Savings)	Mean (kWh Savings)	# Projects in Sample
BNC	1	89	99	62,957	20,431	6
BNC	2	23	63,680	158,104	100,942	6
BNC	3	12	158,801	458,160	258,072	12
Subtotal BNC		124	99	458,160	58,362	24
BEF Custom	1	270	60	46,743	11,660	16
BEF Custom	2	52	47,729	139,253	83,709	16
BEF Custom	3	22	140,527	384,945	243,335	16
BEF Custom	4	9	427,967	1,691,950	813,981	9
Subtotal Custom		353	60	1,691,950	57,168	57
BEF Prescriptive	1	277	72	11,529	2,610	6
BEF Prescriptive	2	46	11,576	49,032	22,706	6
BEF Prescriptive	3	6	64,137	273,907	127,417	6
Subtotal Prescriptive		329	72	273,907	7,696	18
Total		806	60	1,691,950	37,158	99

The sample was also checked to verify that it represented the variety of market tracks offered by EVT. The sample includes projects in ten of the twelve tracks in the BEF and BNC market initiatives. The two tracks not represented in the sample are 6012MFMR and 6014FARM. Since only four projects in total were completed in these two tracks in 2005, one would not necessarily expect them to be selected in a random sample.